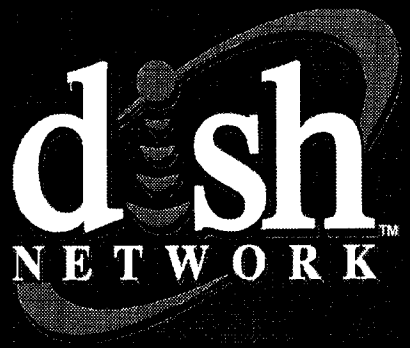
Federal Communications Commission
Technical Presentation

DBS Spectrum/Capacity Issues

May 2002



David Baylor
Executive Vice President, Technology and Operations, DIRECTV

Mike T. Dugan
President and Chief Operations Officer, EchoStar Communications

Presenters

- GM/Hughes/DIRECTV
  - David Baylor
  - Larry Chapman
- EchoStar
  - Mike Dugan
  - Michael Schwimmer

EchoStar – Hughes Merger Issues

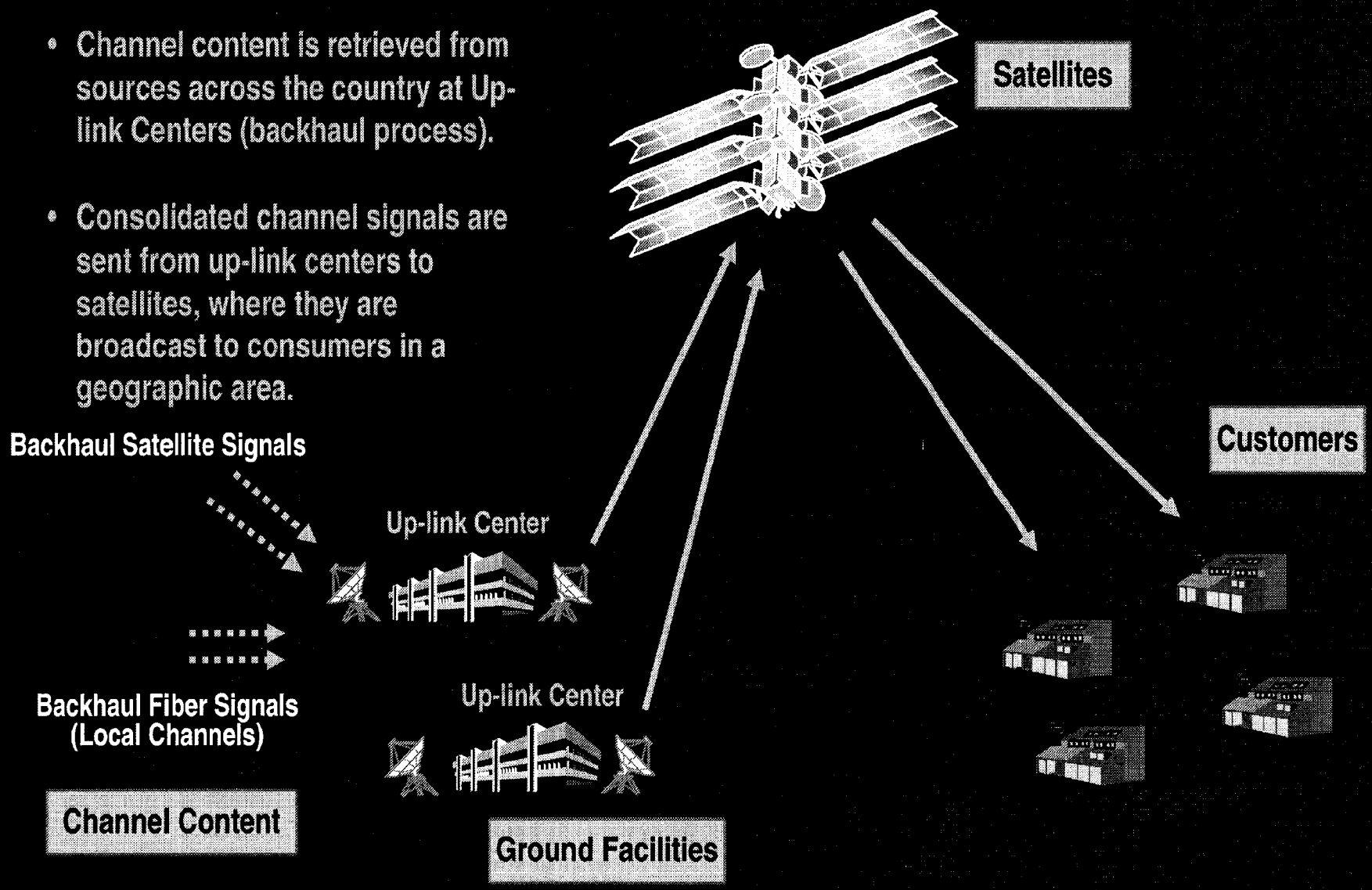
- DBS spectrum/capacity benefits. Why the merger is necessary to achieve them. (May 15 briefing)
- Roll-out of true satellite broadband for consumers. Why the merger is necessary to achieve this. (Subsequent briefing)
- Competitive effects. Why the merger will promote overall competition. (Subsequent briefing)

Outline of Presentation

- Brief technical overview of DBS service configuration
- Current DIRECTV/EchoStar spectrum utilization/programming duplication
- Each company's ability to provide local service in a limited number of cities
- "Local Channels, All Americans" becomes feasible with the merger
- The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- Transition process

Top Level Infrastructure

- Channel content is retrieved from sources across the country at Up-link Centers (backhaul process).
- Consolidated channel signals are sent from up-link centers to satellites, where they are broadcast to consumers in a geographic area.



DBS Frequency Assignments

- In the United States, the FCC issues DBS authorizations for specific DBS frequencies and orbital locations

Current DBS Authorizations

	175° W.L.	166° W.L.	157° W.L.	148° W.L. Wing	119° W.L. Core	110° W.L. Core	101° W.L. Core	61.5° W.L. Wing
DIRECTV					11	3	32	
EchoStar	22 (permit) + 11 western unspecified (permit)			24 + 8 (STA)	21	29		11 + 13 (STA)
R/L DBS								11*
Dominion								8
Unallocated	10	32 each (Compass/Northpoint Application Pending)		8*				2*

* = In use by EchoStar under STA

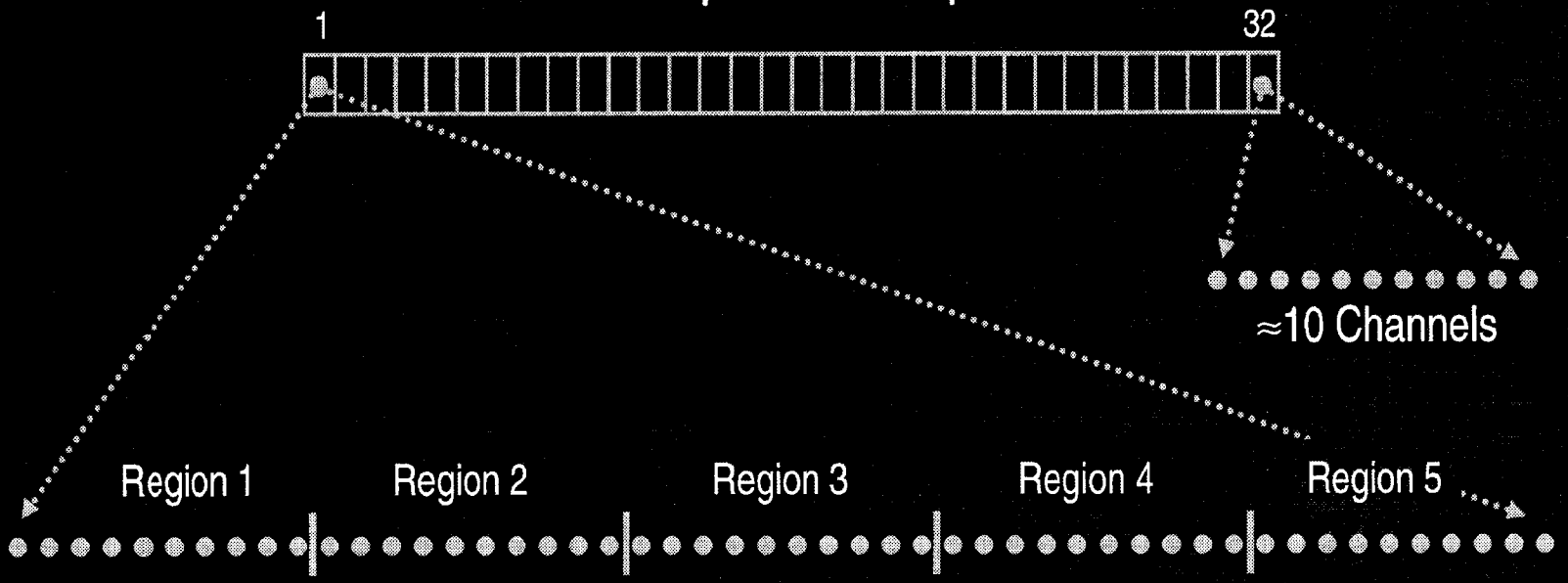
Frequency vs. Channel Capacity

Typical Orbital Slot - 32 Frequency Spectrum

(Fixed Freq. Range; FCC Regulated; One Transponder Per Frequency)

Spot Beam Transponder:
5x Frequency Re-Use

CONUS Transponder:
No Frequency Re-Use

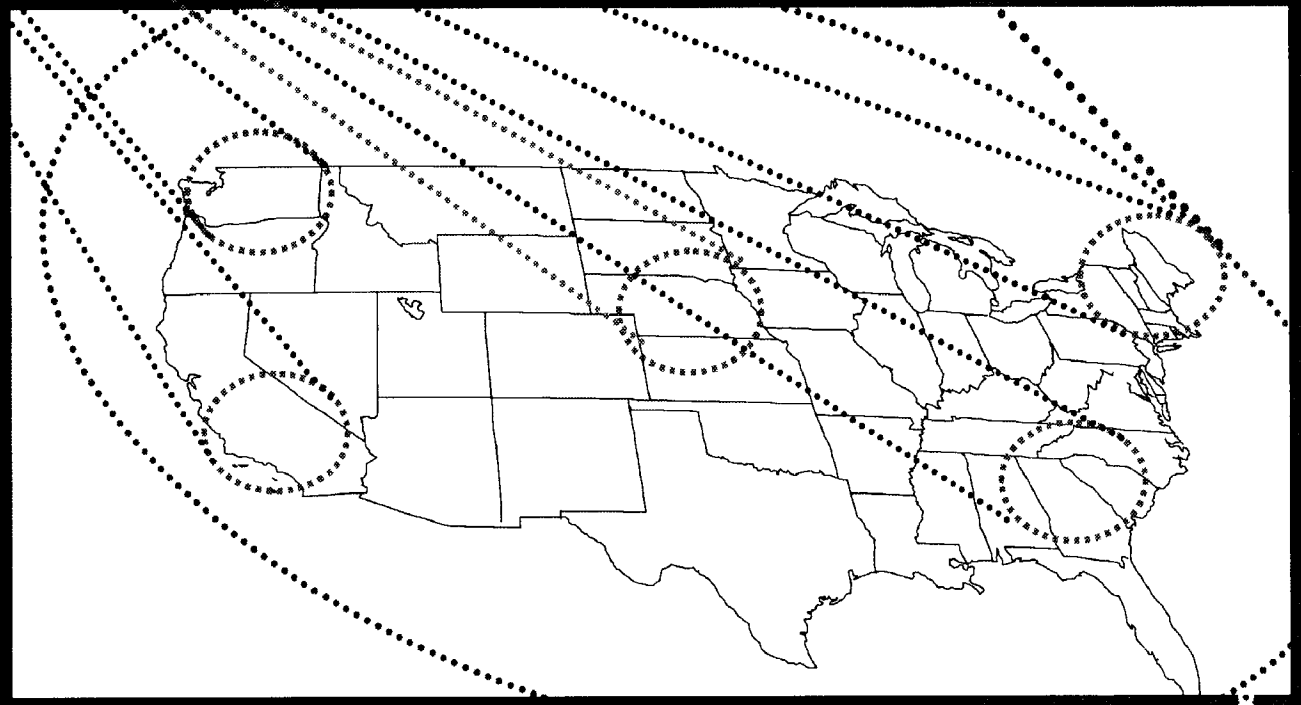


≈50 Channels – 5 Geographically Isolated Regions
(≈10 Channels Per Region)

National vs. Spot Beams

Spot Beam Satellite

CONUS/National Beam Satellite



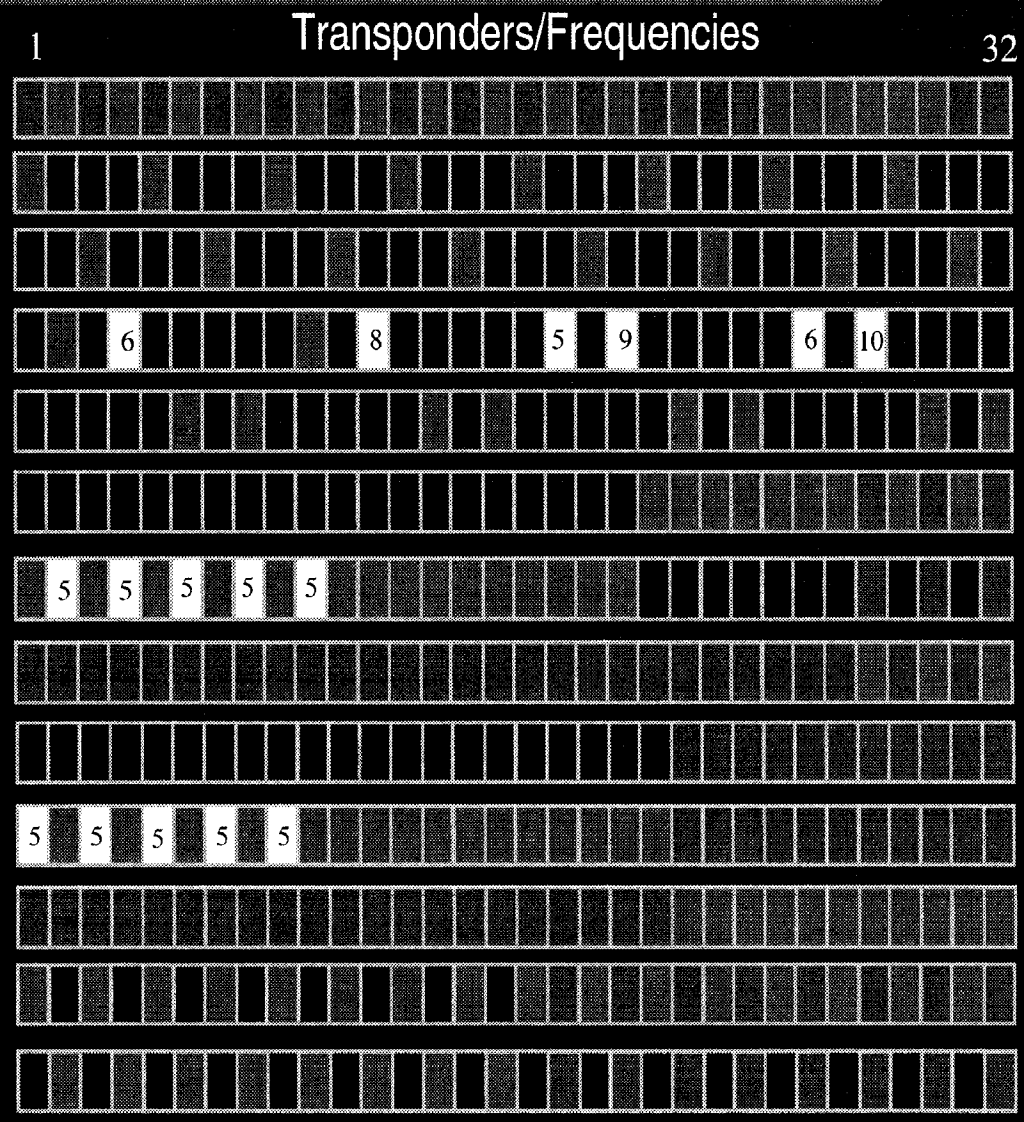
CONUS vs. Wing Slots

- From a CONUS slot, a satellite can transmit a signal that will cover the entire United States
- From a Wing slot, a satellite can broadcast to only a portion of the United States
- The same frequencies are used at each of the orbital slots, with distance between orbital positions providing isolation from interference
  - Use of two slots farther than about 20 degrees apart requires the customer to employ additional receive antennae
  - Any combination of CONUS and Wing slots requires two or more antennae

Outline of Presentation

- ☑ Brief technical overview of DBS service configuration
- Current DIRECTV/EchoStar spectrum utilization/programming duplication
- Each company's ability to provide local service in a limited number of cities
- "Local Channels, All Americans" becomes feasible with the merger
- The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- Transition process

Frequency Map For EchoStar and DIRECTV



EchoStar Satellites Currently In Use

Name	Orbital Location	Launch Date	Transponder Capability	DBS Frequencies Used
EchoStar III	61.5 W.L.	10/5/1997	32 low power/16 high power	23 + 9 (occasional use)
EchoStar V	110 W.L.	09/23/99	32 low power/16 high power	27 low power, 2 high power
EchoStar IV	119 W.L.	05/05/98	12 low power/6 high power (Due to aanomaly/failure)	0 (On-orbit back-up)
EchoStar VI	119 W.L.	07/14/00	32 low power/16 high power	1 high power (On-orbit back-up)
EchoStar VII	119 W.L.	02/21/02	16 high power + 5 spot beam (25 equivalent) / 32 low power	15 high power + 5 spot beam
EchoStar I	148 W.L.	12/28/95	16 low power	16
EchoStar II	148 W.L.	09/10/96	16 low power	4 + 12 (occasional use)

DIRECTV Satellites Currently In Use

Name	Orbital Location	Launch Date	Transponder Capability	DBS Frequencies Used
DIRECTV 2	101 W.L.	08/03/94	16 low power/8 high power	8 high power
DIRECTV 1R	101 W.L.	10/09/99	16 high power	8 high power
DIRECTV 4S	101 W.L.	11/26/01	6 spot beam (42 equivalent) /10 high power	6 spot, 2 high power
DIRECTV 3	101 W.L.	06/09/95	16 low power/8 high power	8 high power
DIRECTV 1	110 W. L.	12/17/1993	16 low power/8 high power	3 high power
DIRECTV 5	119 W.L	05/07/02	32 low power/16 high power	11 high power (planned June 2002)
DIRECTV 6	119 W.L	03/06/97	32 low power/16 high power	11 low power (to become in-orbit spare)

Future Satellites

Name	Orbital Location	Expected Launch Date	Transponder Capability	Company
DIRECTV 7S	119 W. L.	October, 2003	4 spot/7 high power	DIRECTV
EchoStar VIII	110 W. L.	June, 2002	16 highpower + 5 spot beam (25 effective) or 32 low power	EchoStar

EchoStar & DIRECTV Current Spectrum Usage

WEST WING

148°

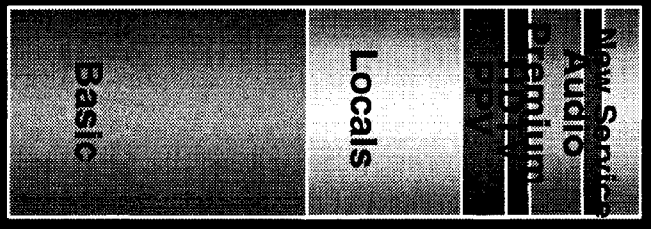
CONUS

101°, 110°, 119°

EAST WING

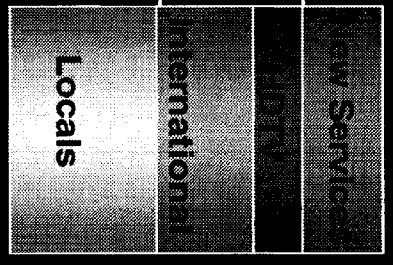
61.5°

Note:
Service representations are proportional to number of transponders utilized.



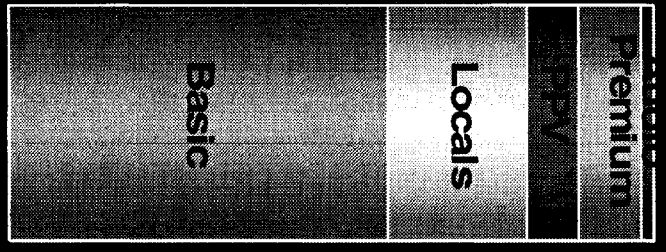
DIRECTV 46 transponders

Duplicated On East Wing

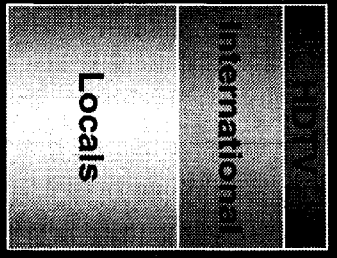


24 transponders

EchoStar



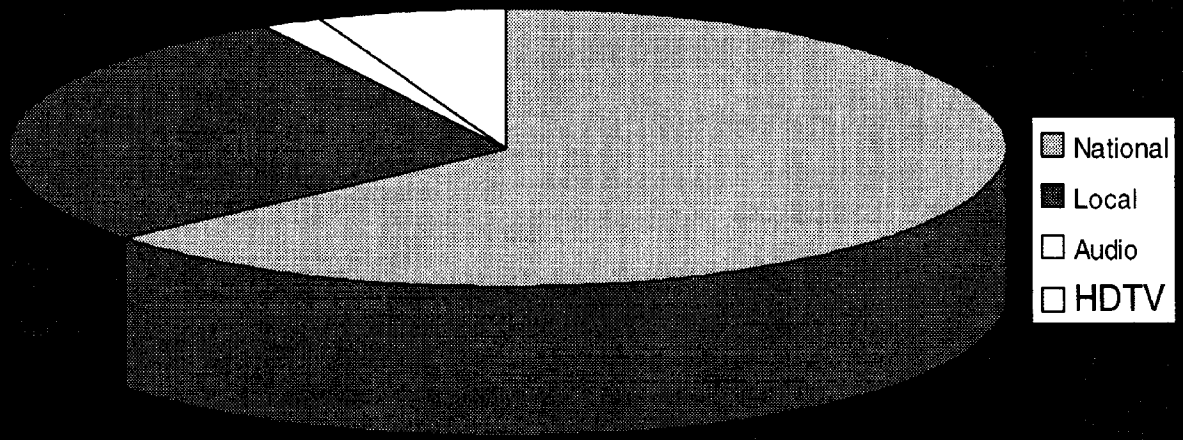
50 transponders



17 transponders

Spectrum Trade-Offs

Allocation of DBS Spectrum

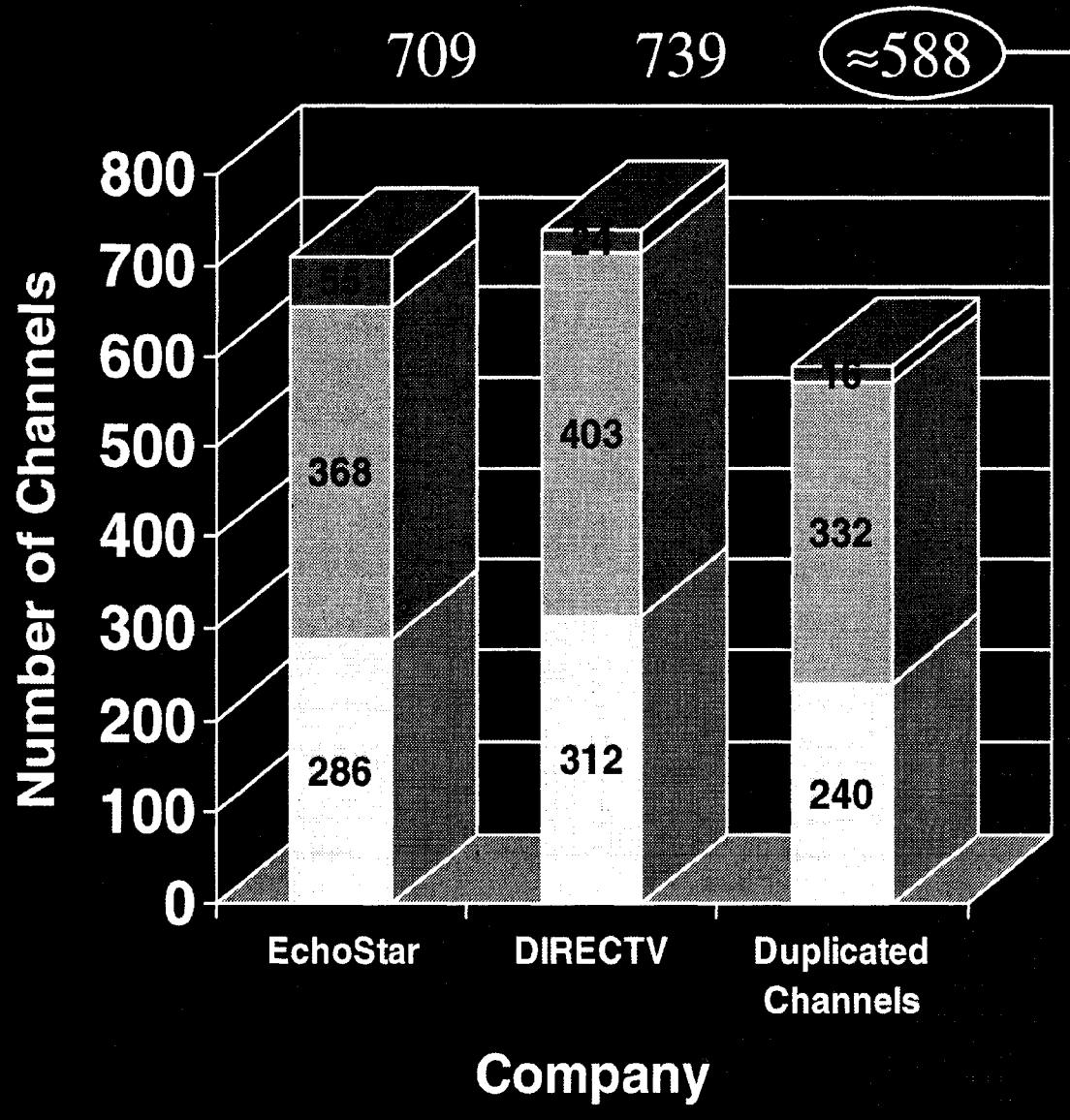


Each addition of programming...

...generally requires displacement of something else

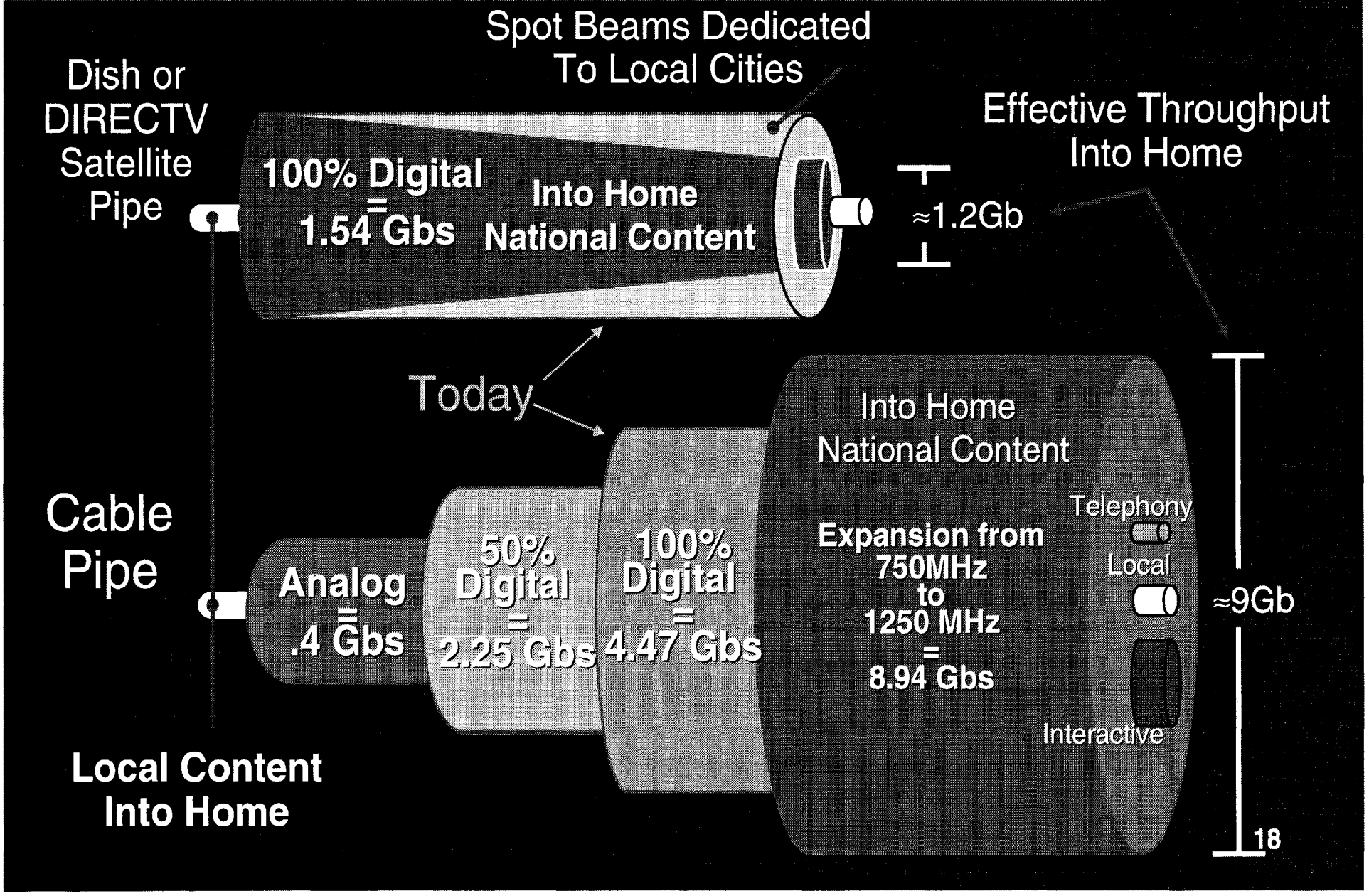
National Services ↔ Local Services (with spot beams) ↔ Interactive Services ↔ HDTV Services ↔ Customer Satisfaction

EchoStar/DIRECTV Channel Comparison

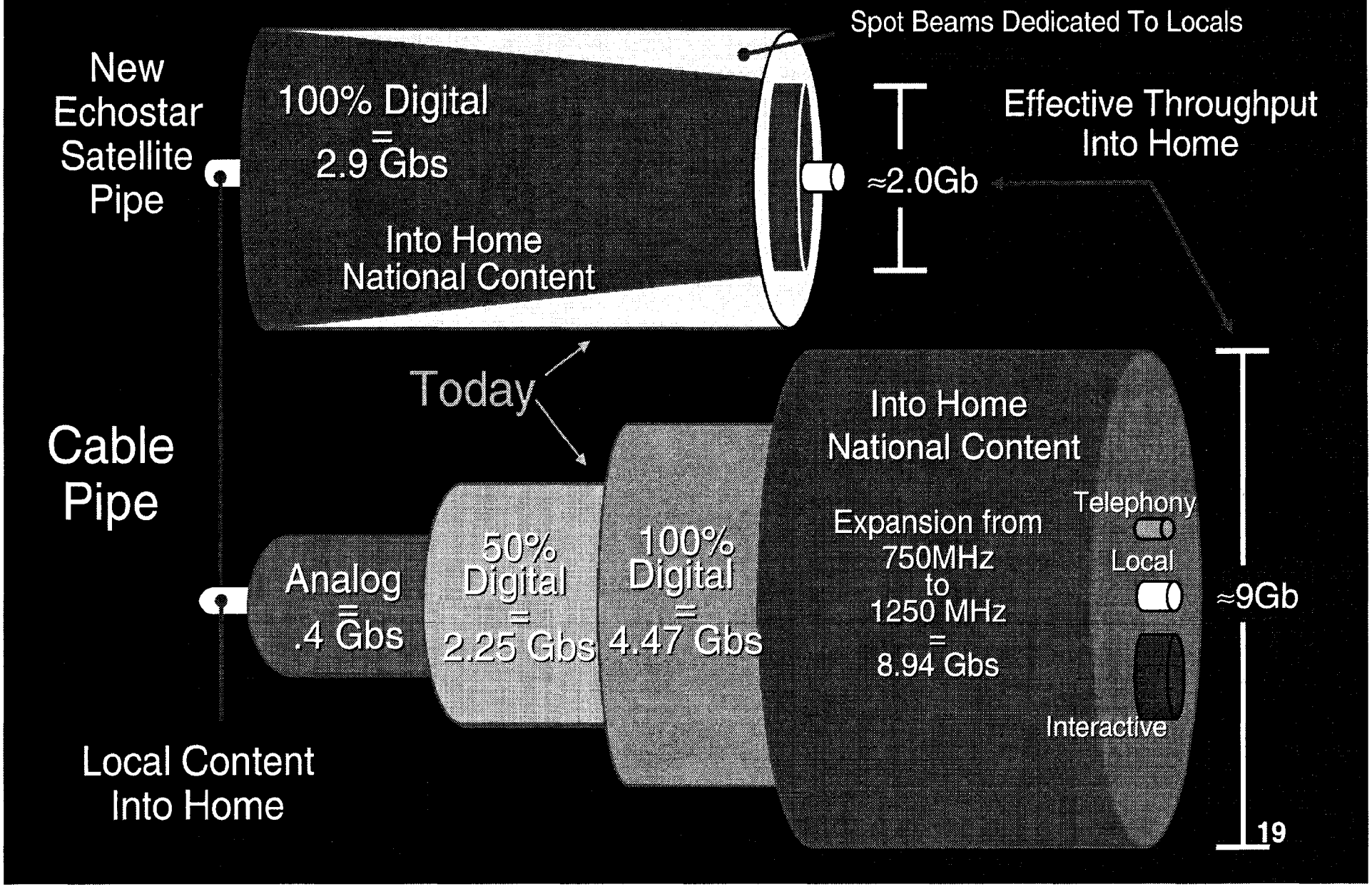


The vast majority of each company's channel line-up is duplicated.

Pre-Merger Bandwidth Comparison: Fat Pipe Model



Post-Merger Bandwidth Comparison: Fat Pipe Model



The New Digital Cable Services

- Expanded Digital Tiers
- Expanded Specialty Programming
- Expanded Near-Video-on-Demand
- High Speed Internet
- Video-on-Demand
- Subscription Video-on-Demand
- Out-of-Market Sports Packages
- High Definition Television
- Interactive Services
- Electronic Program Guide
- Telephony

Outline of Presentation

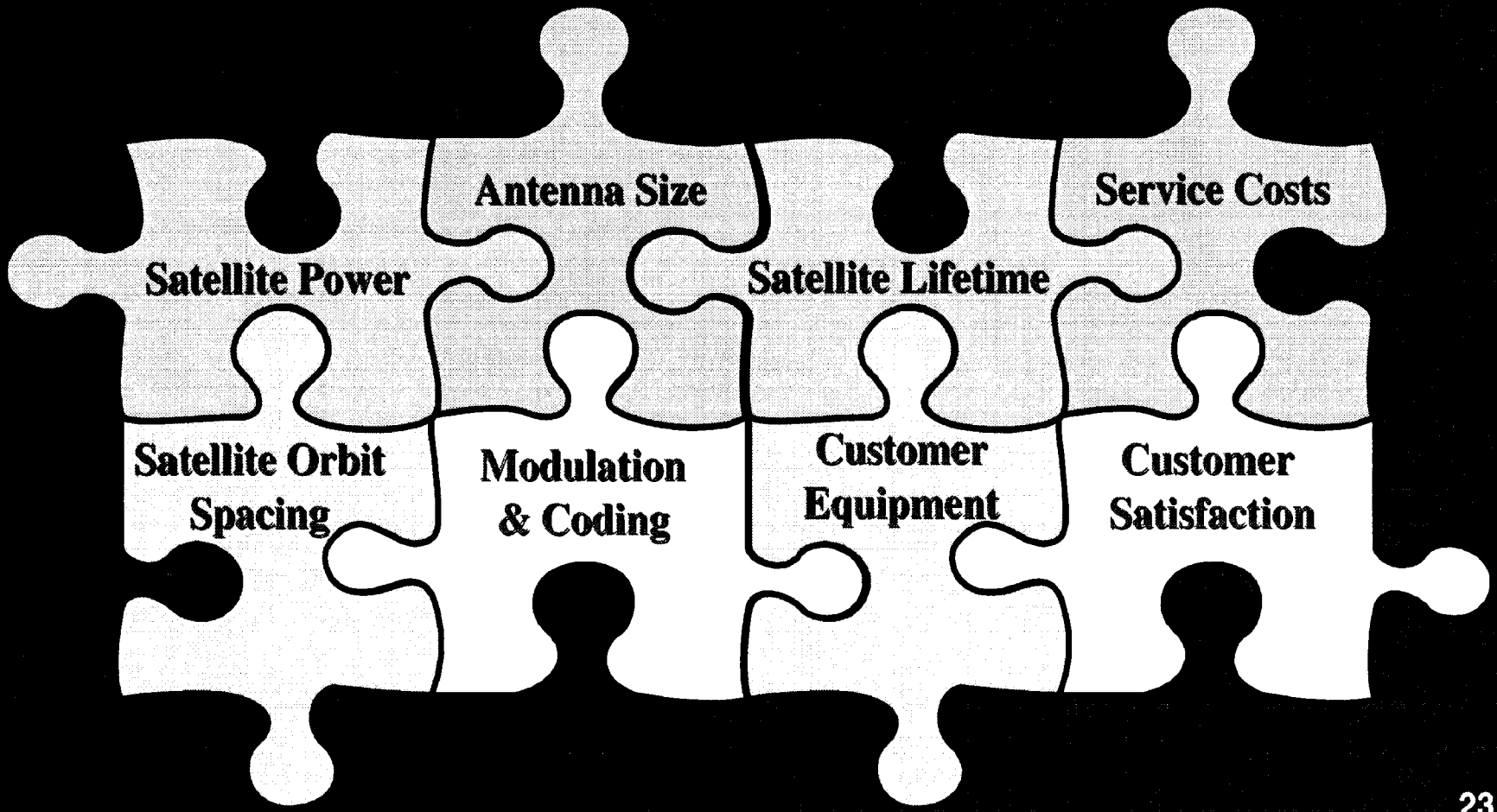
- ☑ Brief technical overview of DBS service configuration
- ☑ Current DIRECTV/EchoStar spectrum utilization/programming duplication
- Each company's ability to provide local service in a limited number of cities
- "Local Channels, All Americans" becomes feasible with the merger
- The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- Transition process

Neither EchoStar Nor DIRECTV Alone Has Adequate Competitive Capacity

- Opponents have proposed that technology is the solution to DBS operators' capacity constraints
  - Opponents assume compression ratios and other technical modifications that are not achievable in the foreseeable future, or would result in unacceptable quality
  - Opponents propose modulation schemes and other system characteristics that are significantly more susceptible to interference and would substantially reduce service quality
- Current and planned DBS satellites cannot provide local channels in all 210 DMAs without the merger
  - Neither company can independently provide local channels to more than a limited number of DMAs with its current and planned fleets of spot-beam satellites
- Technological issues aside, the economics of providing local channels to 210 DMAs are prohibitive without the merger

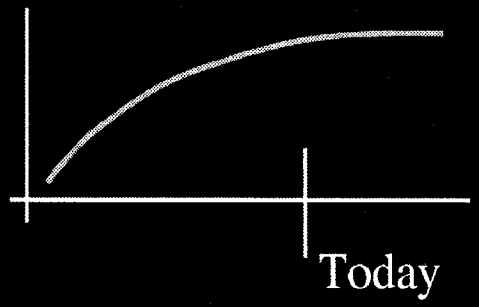
Technology Interrelationship

- Future satellite technology must be introduced cautiously due to the interrelationship of all contributing technologies including any subsequent effect on customers



Compression

- Compression
  - Improvements to existing compression technology will be limited



  - Future compression improvements are available to all competitors as well, with no legacy capital for new digital competitors

Compression Technology

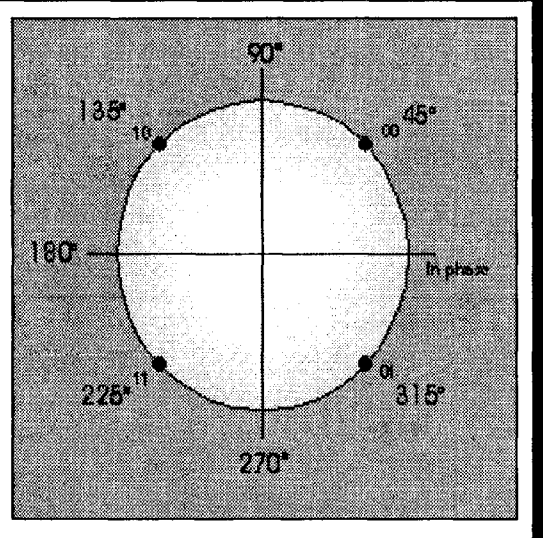
- Compression technology uses algorithms to reduce the amount of information needed to be transmitted. For instance, where a background scene is unchanged while foreground action takes place, it is not necessary to transmit new information for the background content.
- Digital compression requires a tradeoff between channel quantity and quality.
- In 1994, available compression technology allowed DIRECTV to broadcast 6 channels for every 1 transponder. Due to technical advancements, EchoStar and DIRECTV can currently transmit 8-10 CONUS channels per transponder with optimal quality.

Compression Technology, Cont'd

- **Uncompressed rates:**
  - Standard TV: 350K pixels x 3 colors x 10 bits x 30 fps = 315 Mb/s
  - HDTV: 2M pixels x 3 colors x 10 bits x 30 fps = 1.8 Gb/s
- **Color Difference rates (for studio use):**
  - Standard TV: 270 Mb/s
  - HDTV: 1.4 Gb/s
- **MPEG 2 compressed rates (for transmission):**
  - Standard TV: Approx. 3.2 Mb/s
  - HDTV: Approx. 18 Mb/s
- **A high power 24 MHz DBS transponder has a total data throughput of 40 Mb/s including video, audio, data and error correction**

Modulation

- Modulation technology changes content to a wave form transmittable over radio spectrum
  - AM (Amplitude Modulation) and FM (Frequency Modulation) are examples
- EchoStar, DIRECTV, and nearly all satellite applications use QPSK (Quadrature Phase-Shift Keying) modulation
  - More efficient than other common forms of modulation
  - Each symbol transmitted contains 2 bits of information



quadrature phase-shift keying

8PSK Modulation and Turbo Coding

- Requires higher power levels for same rain margin
- Not all transponders can be high power
- Requires fielded receivers to be replaced
- Efficiency improvements are limited, making cost to replace fielded receivers unacceptable

"Super-Satellites"?

- Proposed "super satellites" are beyond the mass and power limits of commercial satellite technology, require significant advances in satellite and earth station antenna design and involve substantial risks of catastrophic system failure

- Many of the technologies postulated for such a super satellite have not been commercially proven, and no one satellite incorporating a combination of all of these technologies has ever been deployed commercially anywhere in the world

Local Channel Economics

Costs

- Spectrum Opportunity Costs
- Signal Collection & Backhaul
- Satellite & Ground Facilities
- Retransmission Fees

Benefits

- Local Programming Revenue
- Subscriber Lift
- Decreased Churn

Factors in Cost/Benefit Analysis

- Number of Households
- Penetration
- Number of Stations
- Complementary Programming
- Spot Beam Placement
- Demographics
- Competition

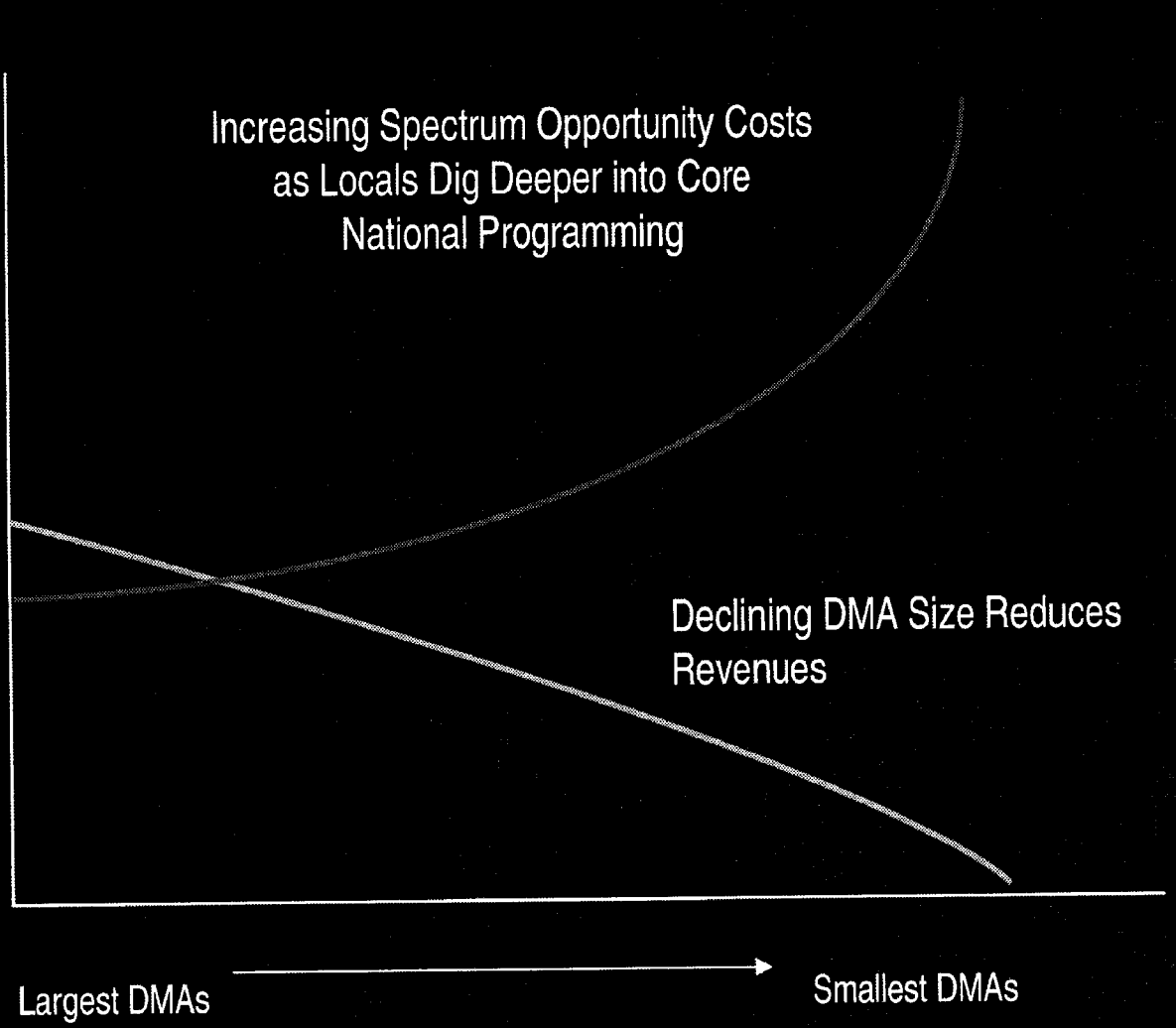
Pre-Merger Local Channel Economics Costs vs. Benefits

$ Costs

- Opportunity Costs (lost rev. from certain programmers and premium content, loss of current subs, loss of future rev. flows and future subs)
- Direct Costs (backhaul costs, satellite capacity, retrans. fees, ground facilities, etc.)

$ Revenue And Other Benefits

- Local Sub. Fees
- Subscriber Lift due to More Effective Competition with Cable in Limited Areas



Projected Number of DMAs Each Company Will Serve on a Standalone Basis

- DIRECTV: Approximately 70 With DIRECTV 7S (51 without 7S)
- EchoStar: Approximately 50 With EchoStar VII and VIII

Outline of Presentation

- ☑ Brief technical overview of DBS service configuration
- ☑ Current DIRECTV/EchoStar spectrum utilization/programming duplication
- ☑ Each company's ability to provide local service in a limited number of cities
- "Local Channels, All Americans" becomes feasible with the merger
- The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- Transition process

New EchoStar 1
Current Plan

- If the EchoStar-Hughes merger is successfully consummated, New EchoStar will procure, launch and operate a New EchoStar 1 satellite.
  - Model: TBD
  - Possible Launch Date: Approx. 2 years after the merger closes
  - CONUS slot: 110
  - No. of Transponders: uses 8 DBS frequencies over 38 spot beams for 54 equivalent transponders
  - These frequencies will utilize capacity recovered by eliminating duplicative programming
  - Expected End-of-Life: +15 years after launch

New EchoStar 1,Cont'd

- Supplements spot-beam coverage of DIRECTV 4S and 7S, and EchoStar VII and VIII
- Combined with other satellites, allows service to all 210 DMAs
- Costs approximately $300 million total (satellite, launch, insurance, etc.)
- Supporting ground infrastructure requires additional cost
- Supports achievable transition plan for existing customer base

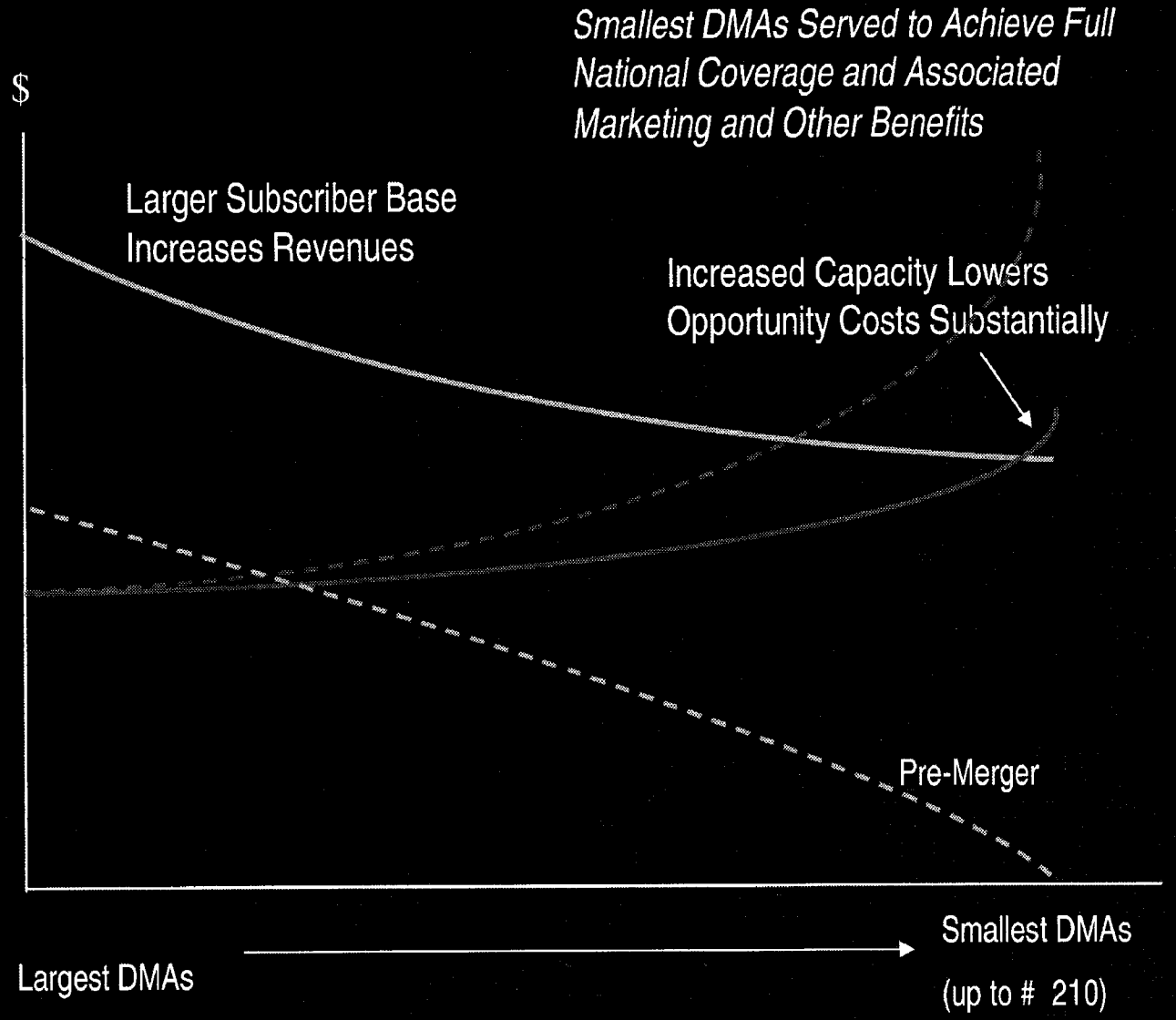
Post-Merger Local Channel Economics
Costs vs. Benefits

$ Revenue And Other Benefits

- Locals Sub. Fees Increase with Subscriber Base
- Inc. Subscriber Lift with Full Local Coverage
- True Nationwide Competition with Cable

$ Costs

- Direct Cost Savings due to Consolidation
- Opportunity Costs Are Reduced Substantially due to Spectrum Efficiencies



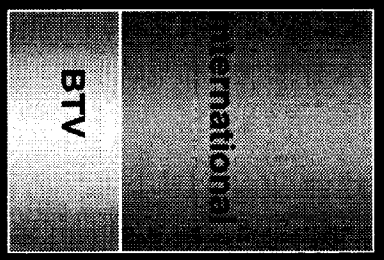
Outline of Presentation

- ☑ Brief technical overview of DBS service configuration
- ☑ Current DIRECTV/EchoStar spectrum utilization/programming duplication
- ☑ Each company's ability to provide local service in a limited number of cities
- ☑ "Local Channels, All Americans" becomes feasible with the merger
- The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- Transition process

Post-Merger Spectrum Usage

WEST WING

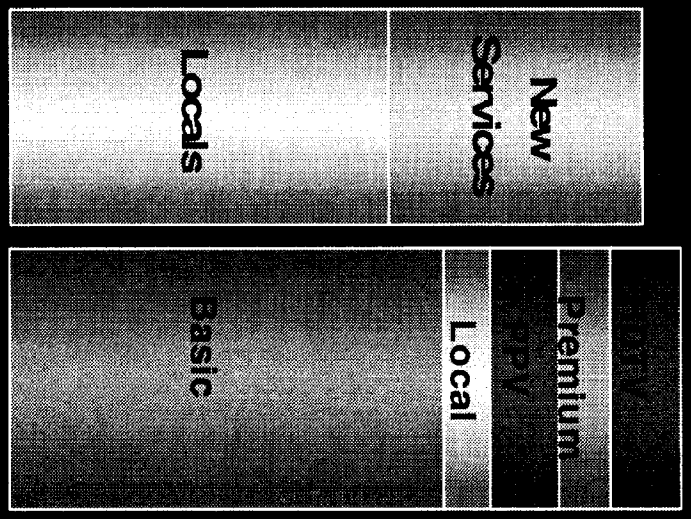
148°



24 transponders

CONUS

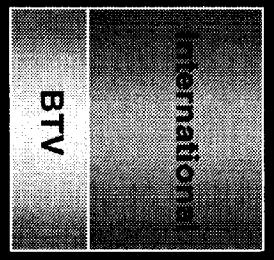
101°, 110°, 119°



96 transponders

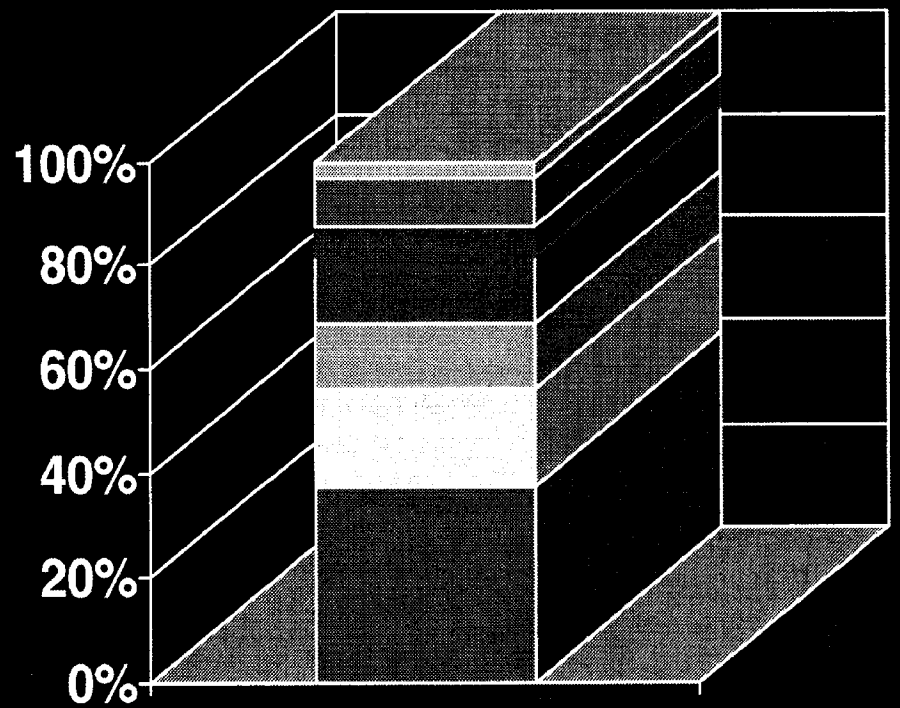
EAST WING

61.5°



17 transponders

Potential New Services



- Public Interest
- Foreign Language
- Interactive
- HDTV
- NVOD / PVR
- General Interest & Niche Programming
- Locals

For Illustrative Purposes only

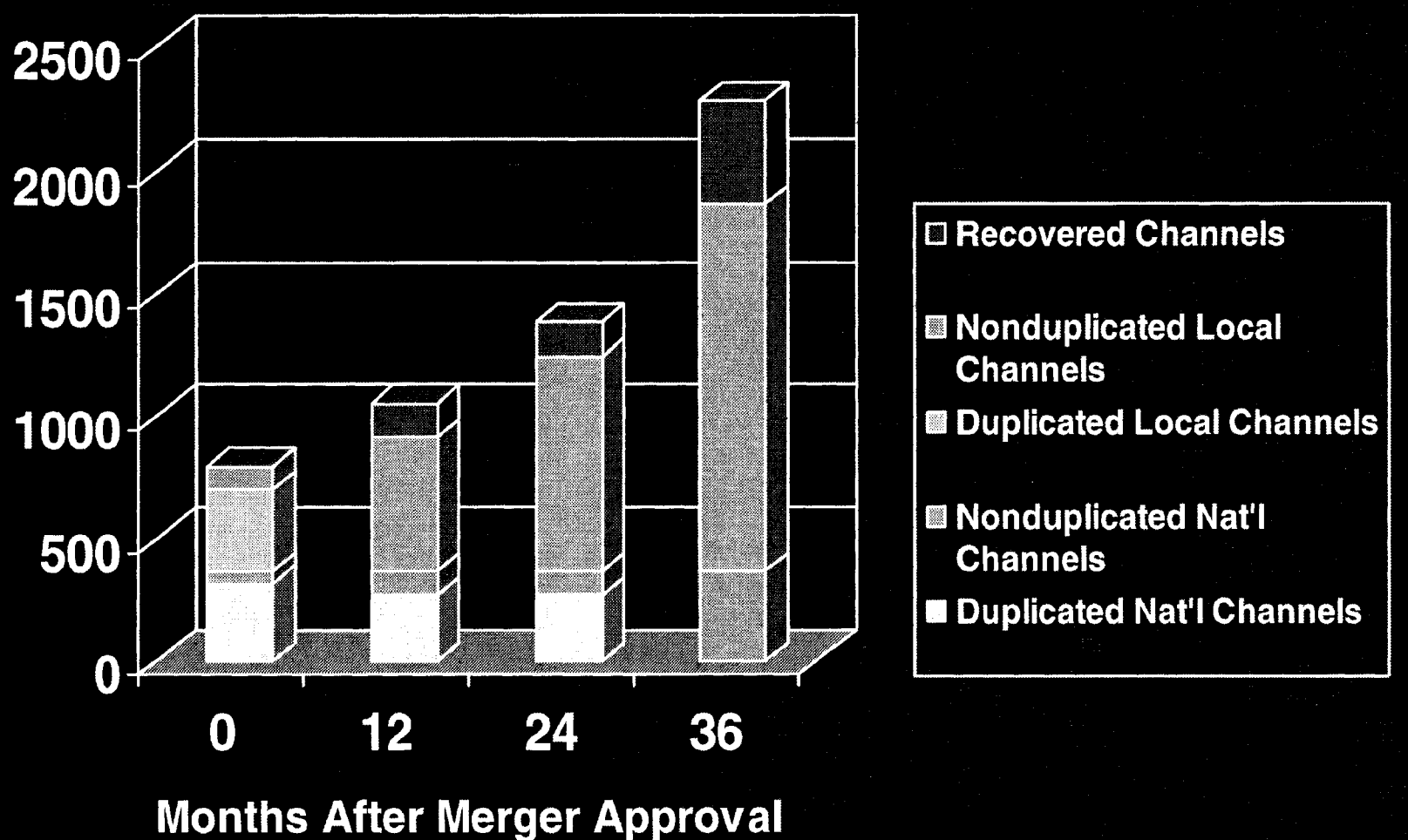
Outline of Presentation

- ☑ Brief technical overview of DBS service configuration
- ☑ Current DIRECTV/EchoStar spectrum utilization/programming duplication
- ☑ Each company's ability to provide local service in a limited number of cities
- ☑ "Local Channels, All Americans" becomes feasible with the merger
- ☑ The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- ■ Transition process

Phased Spectrum Recovery

- Deploy "dual speak" set-top boxes, and triple-LNB dish capable of receiving signals from three orbital locations to all *new* subscribers. Move all DISH Network subscribers to DISH 500, dual LNB system.
- Migrate selected programming and associated subscribers to single platform, in order to free currently used spectrum:
  - Spanish Language and International Services
  - HDTV
  - Selected Locals
- Use EchoStar-VII & VIII to accelerate service to new local markets prior to DIRECTV 7S and New EchoStar 1
- Ultimately place all "core" programming at either 101 W.L. or 110 W.L. orbital location, eliminating duplicated programming and freeing *national* capacity.

Post-Merger Spectrum Recovery



Outline of Presentation

- ☑ Brief technical overview of DBS service configuration
- ☑ Current DIRECTV/EchoStar spectrum utilization/programming duplication
- ☑ Each company's ability to provide local service in a limited number of cities
- ☑ "Local Channels, All Americans" becomes feasible with the merger
- ☑ The merger will free up spectrum for more High Definition Television, near video on demand, interactive services, ethnic programming and better service quality
- ☑ Transition process